

A note on the Kaladungar phosphorite occurrence, Jaisalmer District, Rajasthan

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Kaladungar phosphorite occurrence represents the Jaisalmer-Baisakhi transition zone of Middle to Upper Jurassic age. Phosphatic nodules are sporadically distributed in marls and marly calcarenite of Jaisalmer Formation and exposed over a potential area of 0.4 sq km with an average thickness of 0.35 m, while Baisakhi shales contain five phosphatic nodules bearing bands varying in thickness from 0.10 m to 0.35 m. They cover an area of about 0.60 sq km. Preliminary estimate shows that the prospect may have total geological reserves of 2.68 million tonnes with average grade of 12.75% P_2O_5 . The nodules show solubility in 2% formic acid between 34.5% and 39.9% and neutral ammonium citrate between 9.76% and 16.31%.

DURING the course of systematic geological mapping (1975-80) localized occurrences of phosphatic nodules were recorded in Jaisalmer-Baisakhi transition zone near Nibh Dungar, Manpiya, Kuldhar, Rupsi and north of Khara Rann sections. Subsequently better concentration of phosphatic nodules has been recorded in Kaladungar section¹.

These phosphatic nodule-bearing rocks contained in Jaisalmer-Baisakhi transition zone along the Kaladungar section are intermittently traceable over a strike length

of 8 km. Keeping in view the considerable strike length and P_2O_5 content of few nodules of other localities, the economically potential zone of Kaladungar phosphorite has been delineated for preliminary estimate. The estimate is based on delineation of phosphatic nodule-bearing bands which are contained in Baisakhi shale (unit A) and phosphatic fossiliferous calcarenite and marl of Jaisalmer Formation (unit D)². Measurement and sampling of basal Baisakhi shales (unit A) were carried out in two sections along Kaladungar. The average grade has been determined from the analyses of 34 samples including complete nodules, ferruginous cortex, core portion and host rocks.

Kaladungar phosphorite occurrence is located near village Kanod of Jaisalmer district and is approachable by the road from Jaisalmer. The Hamira railway station is about 15 km from the occurrence. Village Hamira has a national highway and rail links both with Jaisalmer and Jodhpur towns. The phosphorite is located north of Khara and Kanod Rann which form part of the area.

The lithostratigraphic set-up of the Hamira-Kanod area covering Kaladungar sections is given in table 1 (ref. 3). These formations in the area are horizontally to sub-horizontally disposed with 2° to 5° dips towards northwest.

Jaisalmer Formation has yielded rich fauna including *Stephenoceras fissum*, *Sindetes Sindensis*, *Reineckeia aff. reissi*, *Grossouvria steinmanni* which indicate Middle Callovian to Oxfordian (Middle Jurassic) age⁴. Baisakhi Formation contains smaller ammonites. The species identified are *Torguatisphinctes sp.*, *T. lenuistriatus*, *Dichotomosphinctes* and *Katrolliceras depressum* which indicate a Kimmeridgian (Upper Jurassic) age. Bedesar

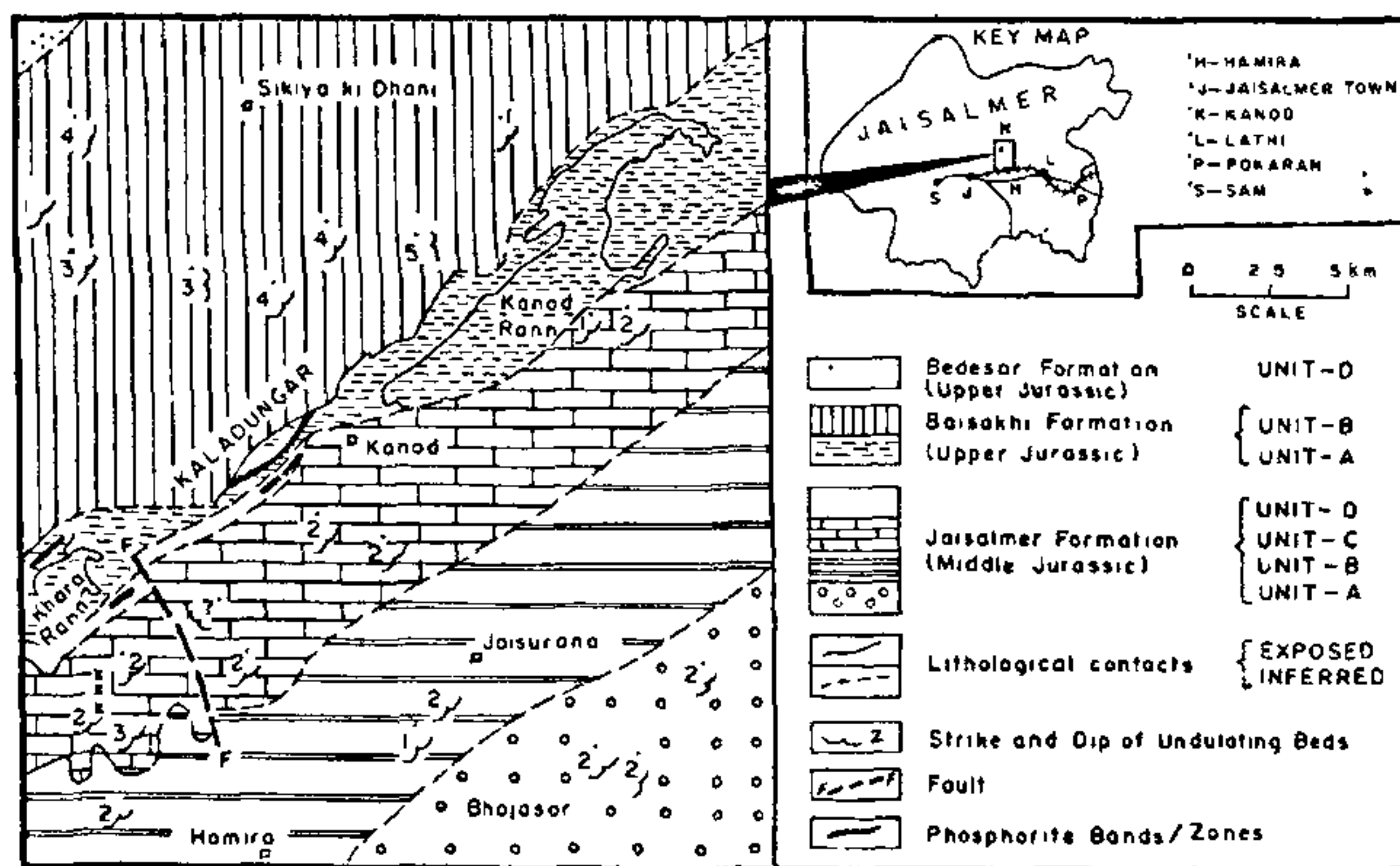


Figure 1. Geology and occurrences of phosphorite in Kaladungar, Jaisalmer district, Rajasthan.

Table 1. Stratigraphic set up of the area

Formation	Lithology
Bedesar Formation (Upper Jurassic)	Ferruginous grits and sandstone
Unconformity	
Baisakhi Formation (Upper Jurassic)	Unit-C: Mainly shales with subordinate sandstone
	Unit-B: Interbedded sequence of calcareous to ferruginous sandstones and fragile sandstone; and shales
	Unit-A: Mainly gypsiferous shales (6.5–7.5 m) at places saline, containing phosphatic nodule bearing ferruginous bands (10–35 cm) with 6 km strike length and 100 m exposed width
Gradational contact	
Jaisalmer Formation (Middle Jurassic)	Unit-D: 70 cm thick oolitic calcarenite and marl zone with phosphatic nodules (4–5 cm) and phosphatised fossils constituting 50% of rock mass with 4 km strike length and 100 m exposed width Calcarenite–gypsiferous shale-sandstone
	Unit-C: Fossiliferous calcarenite calcareous sandstone and fragile sandstone
	Unit-B: Thick fragile sandstone capped by calcilutite and oolitic to pseudo-oolitic calcarenite
	Unit-A: Calcirudite, calcarenite, calcareous sandstone capped by pyrite coated gastropod bearing calcarenite.

Formation yielded *Viratosphinctes-Aulocophinctes* ammonite fauna which indicate a Tithonian (Upper Jurassic) age⁵.

X-ray diffraction analyses of 11 samples of nodules of Baisakhi unit-A comprising phosphatic core and ferruginous cortex revealed that the core mainly contains fluorapatite (2.78 Å and 2.68 Å) with small amount of quartz and kaolinite; and traces of calcite/dolomite, haematite and/or goethite whereas cortex is mainly made up of goethite and/or haematite with good amount of quartz and kaolinite and traces of dolomite and feldspar.

Solubility tests were conducted on two samples drawn from these deposits analysing P₂O₅ 19.80 to 23.05% with high SiO₂ 13 to 16%, Fe₂O₃ 7 to 12% and MgO less than 1%. The CaO/MgO ratio is 1.57% to 1.61%. The solubility of phosphate in 2% formic acid (FA) and neutral ammonium citrate (NAC) has been found to be 39.9% and 34.5% in F.A solution and 16.71 and 9.76% in N.A.C solution. Kaladungar prospect has potentiality for direct application in acidic soils⁶.

Thirty four samples comprising complete nodules,

phosphatic core, ferruginous cortex and host shale have been analysed for P₂O₅ content.

Baisakhi nodules contained in five bands of two sections measured along Kaladungar sections indicate phosphate content varying from 5.88% to 22.42% P₂O₅ while ferruginous cortex contains 0.5 to 9.95% P₂O₅. Host shale contains 0.5 to 1% P₂O₅. The average grade for 1 m cumulative thickness of these bands is around 9.5% P₂O₅.

Jaisalmer phosphatic nodules have shown an average grade of 22.47% P₂O₅ for computed thickness of 35 cm. The average grade determined for the occurrence of Jaisalmer–Baisakhi transition zone is 12.75% P₂O₅.

Preliminary estimate shows that the Kaladungar phosphorite occurrence may have total geological reserves of 2.68 million tonnes with an average grade of 12.75% P₂O₅ in a potential area of 1.00 sq km.

Jaisalmer and Baisakhi phosphatic nodules have marginal grade, reserves and high solubility in formic acid (2%) and neutral ammonium citrate. They are found to be suitable for direct application in acidic soils. They are hosted in horizontally disposed shales and marly limestones, thus may be easily quarried. The other advantage of this prospect is that it has metalled road approach; thus this prospect may find utility in the near future, particularly if selective mining is carried out for local use.

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